CONTEMPORARY REVIEW ON SPONTANEOUS CORONARY ARTERY DISSECTION

DR .RAJAT GANDHI

JACC JOURNAL

INTRODUCTION

- Spontaneous coronary artery dissection (SCAD) is as an important cause of myocardial infarction, especially in young women.
- Increase in number due to easy availability of cath labs and intracoronary imaging .
- Recent studies helped to know natural history, presenting characterstics, etiology, management and cardiovascular outcomes .

INTRODUCTION

- 1500 reported SCAD cases till date .
- Half published in last five years .
- Online community on scad developed by women heart .
- Improved recognition and diagnosis .
- Raised patient awareness .

AIM

- The aim of review is to provide a comprehensive contemporary update of SCAD to help in managing these patients in both the acute and chronic settings.

DEFINITION

- SCAD is defined as a spontaneous separation of the coronary artery wall that is not iatrogenic or related to trauma.
- dissections due to blunt trauma, surgical instruments, or those that are catheter-induced are not deemed to be SCAD.
- this disease is distinct from atherosclerotic disease, the term SCAD refers to NONATHEROSCLEROTIC.

EPIDEMIOLOGY

- SCAD was previously believed to be very rare and to be frequently associated with pregnancy.
- Unfortunately, the true incidence and prevalence of SCAD in the general population is unknown due to significant under diagnosis of this condition.
- the previous reports of SCAD prevalence on coronary angiography of 0.2% to 1.1% were underestimation of SCAD .

EPIDEMIOLOGY

- In a recent Japanese series of 326 ACS patients who underwent routine OCT imaging, SCAD was diagnosed in 4% of cases.
- In a Canadian series of women younger than 50 years of age , SCAD was observed in 9.0%.
- In a recent Australian series of women younger than 60 years of age who underwent angiography , SCAD accounted for 22.5%.

MECHANISM AND PATHOPHYSIOLOGY

- The arterial dissection with SCAD can occur within or between any of the 3 layers (intima, media, or adventitia) of the coronary artery wall.
- Two potential mechanisms are

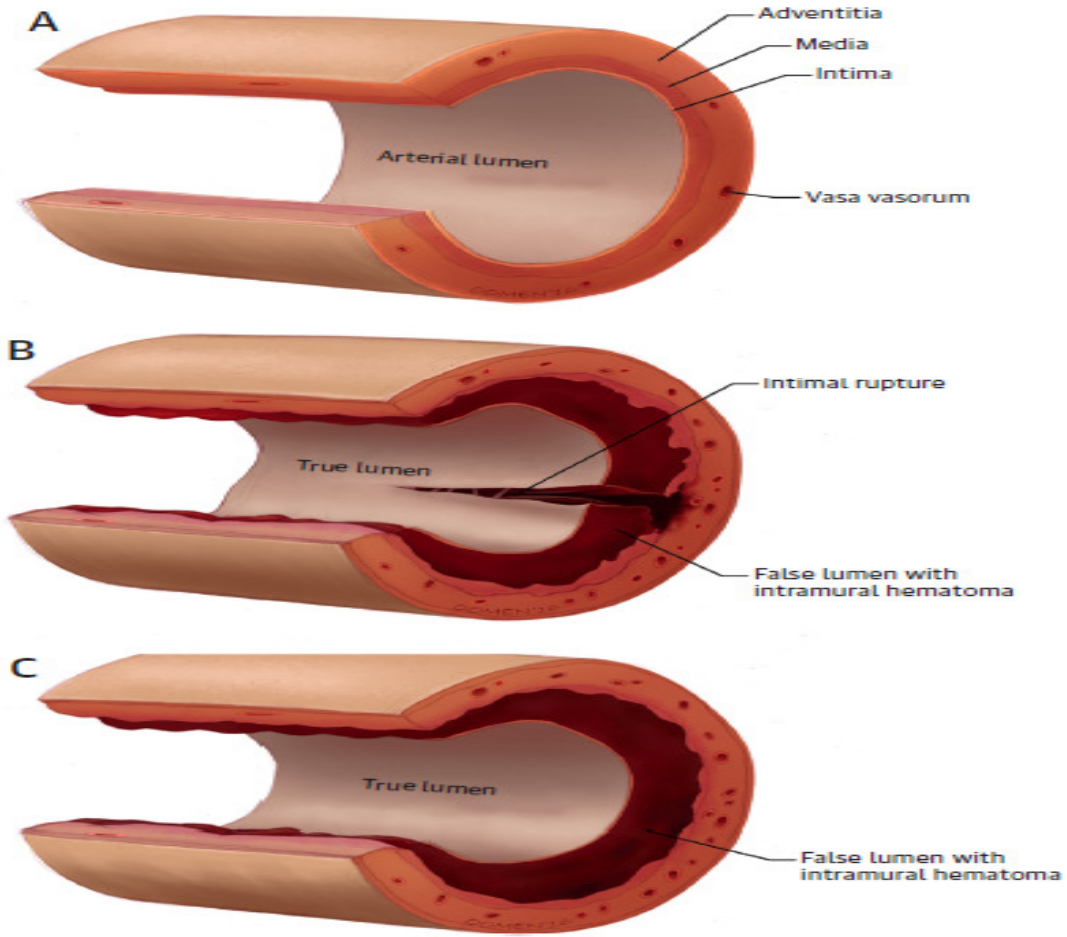
  first is the INTIMAL TEAR HYPOTHESIS.

  second is the MEDIAL HAEMORRAGE HYPOTHESIS.

MECHANISM AND PATHOPHYSIOLOGY

- The first is INTIMAL TEAR HYPOTHESIS, in which a primary disruption in the intimal luminal interface creates an entry point for intramural hematoma (IMH) accumulation inside the false lumen, leading to separation of the arterial wall.
- The second is the MEDIAL HAEMORRAGE HYPOTHESIS, in which a hemorrhage into the arterial wall is the primary mechanism, perhaps due to spontaneous rupture from the increased density of the vasa vasorum.

MECHANISM OF SCAD



PREDISPOSING FACTORS

- Etiology of SCAD appears to be multifactorial.
- Associated underlying predisposing arteriopathy.
- Many potential predisposing nonatherosclerotic arteriopathies for SCAD have been reported.
- The most dominant association reported is fibromuscular dysplasia (FMD).

PREDISPOING FACTORS

- FIBROMUSCULAR DYSPLASIA.
- PREGNANCY RELATED.
- RECURRENT PREGNANCIES.
- CONNECTIVE TISSUE DISORDERS.
- SYSTEMIC INFLAMMATORY DISEASES.
- HORMONAL THERAPY.
- CORONARY ARTERY SPASM.
- IDIOPATHIC.

FIBROMUSCULAR DYSPLASIA (FMD)

- High prevalence of FMD in SCAD patients 72% to 86%.
- FMD is characterised by dysplasia and destruction of smooth muscle cells ,fibroblasts , and connective tissue matrix .
- FMD affected arteries are prone to dissection and aneurysm formation .
- Angiographic feature of tortuosity , dilatation , ectasia and stenosis.

FIBROMUSCULAR DYSPLASIA

- Extracoronary screening of renal and illiac arteries during angiography.
- Intracoronary imaging is helpful in estabilishing link between FMD and SCAD .

PREGNANACY RELATED SCAD

- Early studies suggest that 30% of SCAD cases were peripartum..
- Recent studies suggest <5% of SCAD cases are pregnancy related .
- High progesterone levels during pregnancy can weaken arterial media through alteration of elastic fibre and collagen synthesis .
- Estrogen can cause hypercoaguable state .

PREGNANACY RELATED SCAD

- Together a weakened arterial wall and prothrombotic state increases risk of SCAD and thrombosis.
- Haemodyamic changes during late pregnancy can predispose to SCAD .
- Augmented cardiac output and circulatory volume can increase shear stress .

RECURRENT PREGNANCIES

- Multiparous women are at high risk of SCAD due to repetitive exposure to hormonal changes during pregnancy .
- Integrity of arterial wall is impaired .

HORMONAL THERAPY

- Long term exposure to exogenous estrogen or progesterone is postulated to cause long term changes in coronary arterial architecture .
- Important risk factor for SCAD .

CONNECTIVE TISSUE DISORDER

- Marfon and Ehler danlos type 4 syndromes are associated with SCAD .
- Reported frequency is 1 TO 2%.

PRECIPITATING FACTORS

- Factors which result in valsalva like increase in thoracoabdominal pressure or raise in catecholamines .
- Intense emotional stress , isometeric exercises ,hormonal therapy ,sympathomimetic drugs and intense valsalva like activities (vomiting , coughing , retching , child birth,).

CLINICAL PRESENTATION

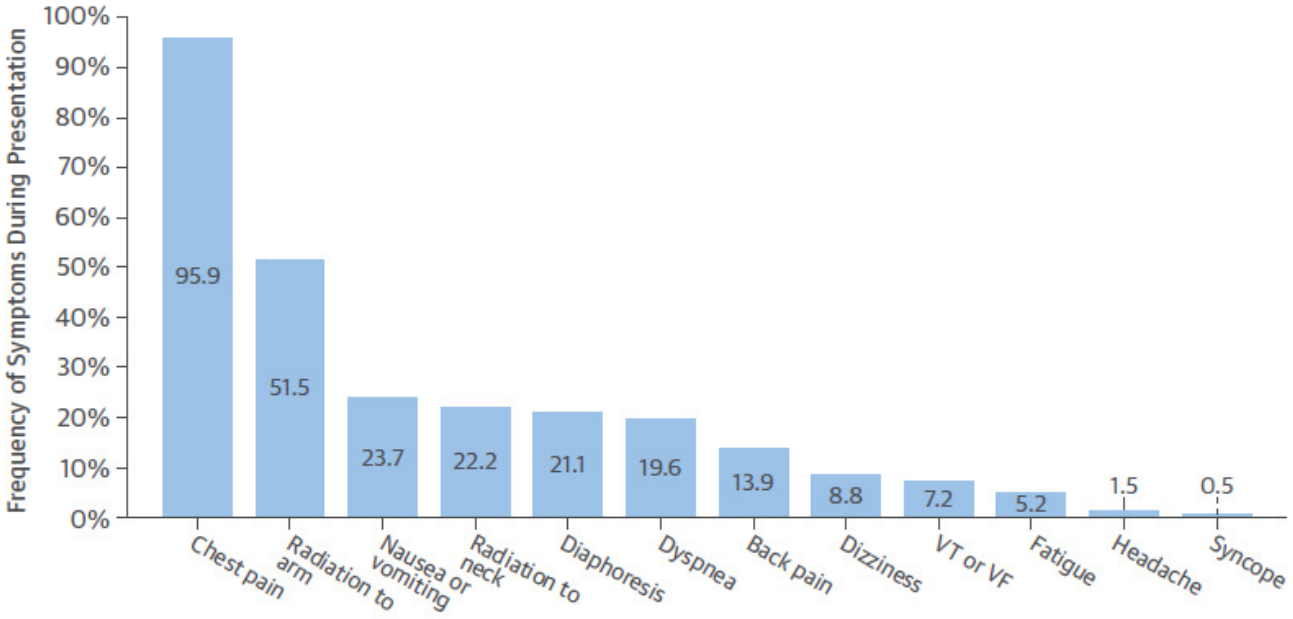
- ELEVATION OF CARIAC ENZYMES .
- STEMI.
- VENTRICULAR ARRTHYMIAS .
- CARDIOGENIC SHOCK.
- SUDDEN CARIAC DEATH.

SYMPTOMS

- CHEST PAIN
- NAUSEA OR VOMITING.
- DIAPHORESIS.
- DYSPNOEA.
- BACK PAIN.
- HEADACHE.
- SYNCOPE.

FREQUENCY OF SYMPTOMS

FIGURE 2 Frequency of Symptom Presentation of SCAD



Chest pain is the most commonly reported symptom with SCAD presentation (51). SCAD = spontaneous coronary artery dissection; VF = ventricular fibrillation; VT = ventricular tachycardia.

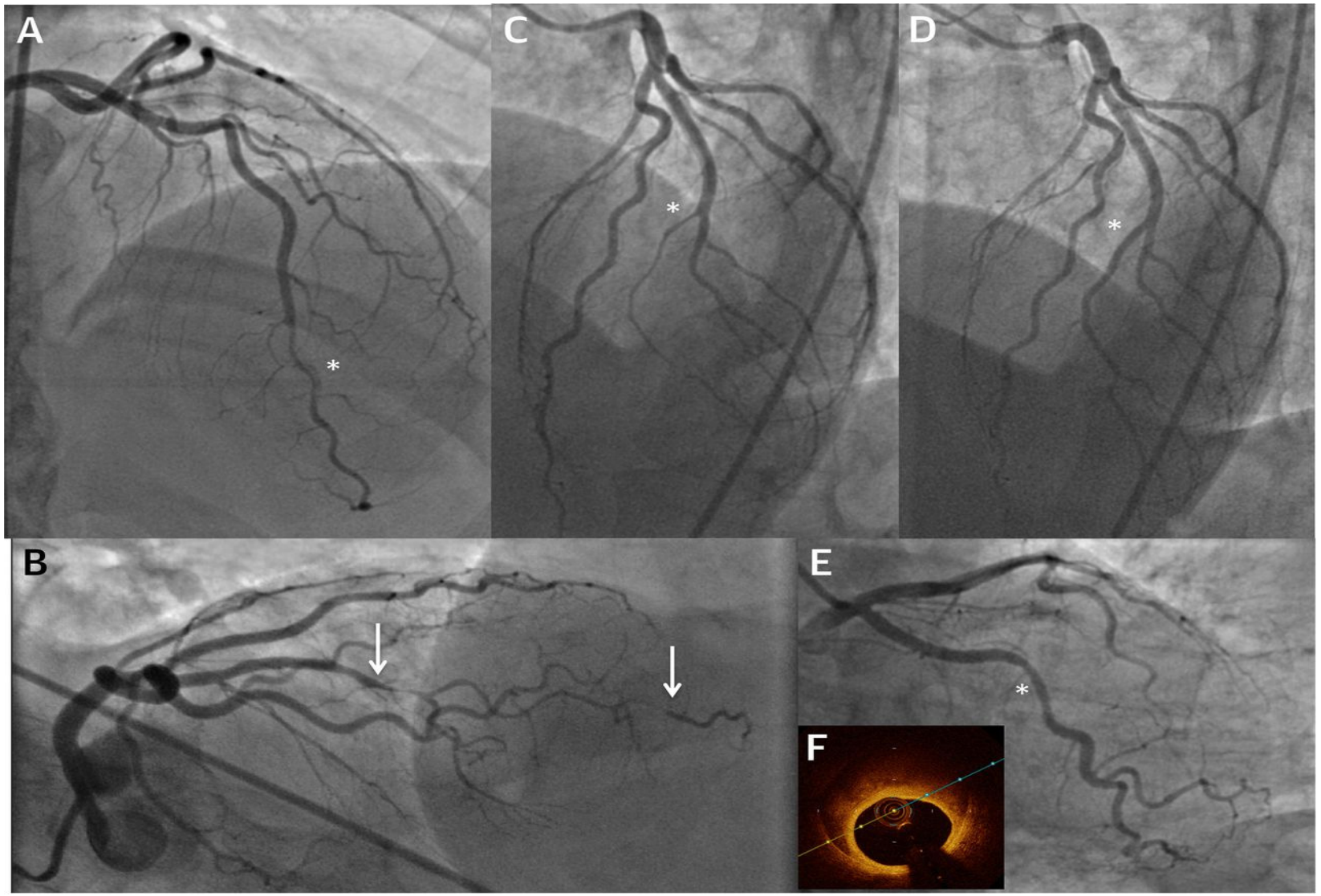
DIAGNOSIS OF SCAD

- CORONARY ANGIOGRAPHY.
- IVUS.
- OCT.

SCAD ANGIOGRAPHIC CLASSIFICATION

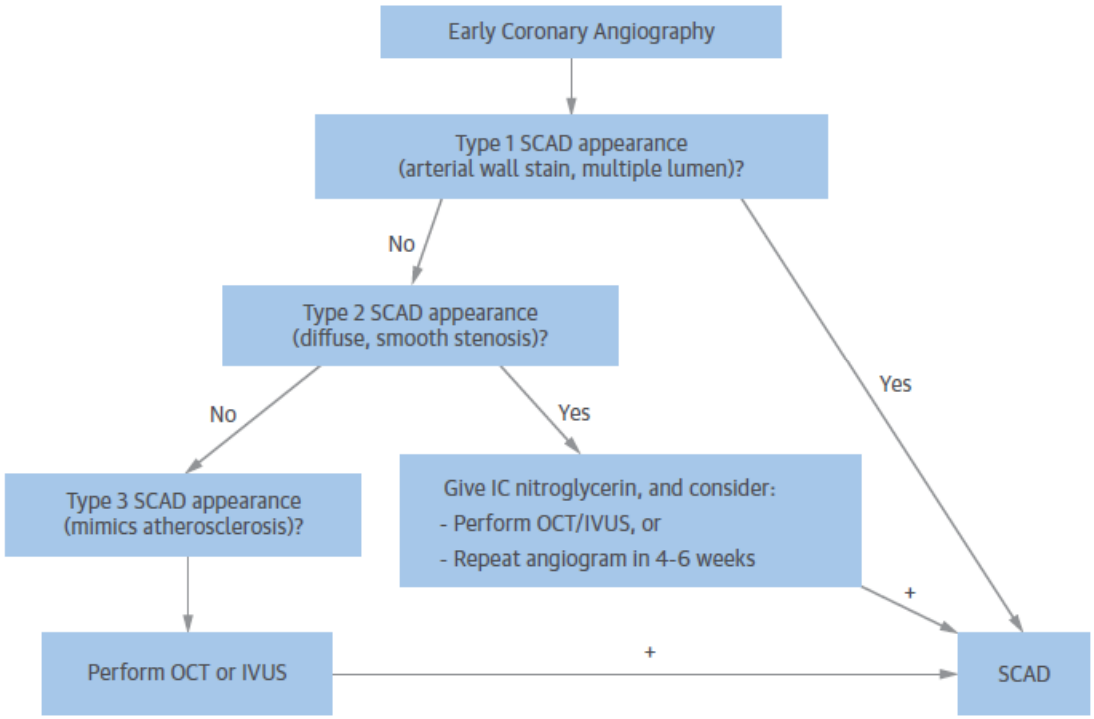
- TYPE 1 – pathognomonic appearance of arterial wall contrast staining with multiple radiolucent lumens.
- Type 2- diffuse stenosis(>20mm) of varying severity and length.
- Type 3 – describes focal or tubular stenosis (<20mm)that mimics atherosclerosis .

TYPES OF SCAD



SCAD DIAGNOSIS

FIGURE 4 Simple Algorithm for SCAD Diagnosis



Early performance of coronary angiography is encouraged to assess for presence of type 1 angiographic SCAD appearance. If absent, the type 2 angiographic SCAD appearance should be sought, and optical coherence tomography/intravascular ultrasound (OCT/IVUS) or repeat angiography to confirm SCAD should be considered. If type 3 angiographic SCAD appearance is present, OCT/IVUS should be performed.
IC = intracoronary; SCAD = spontaneous coronary artery dissection. Reprinted with permission from Saw (55).

SCAD DISTRIBUTION

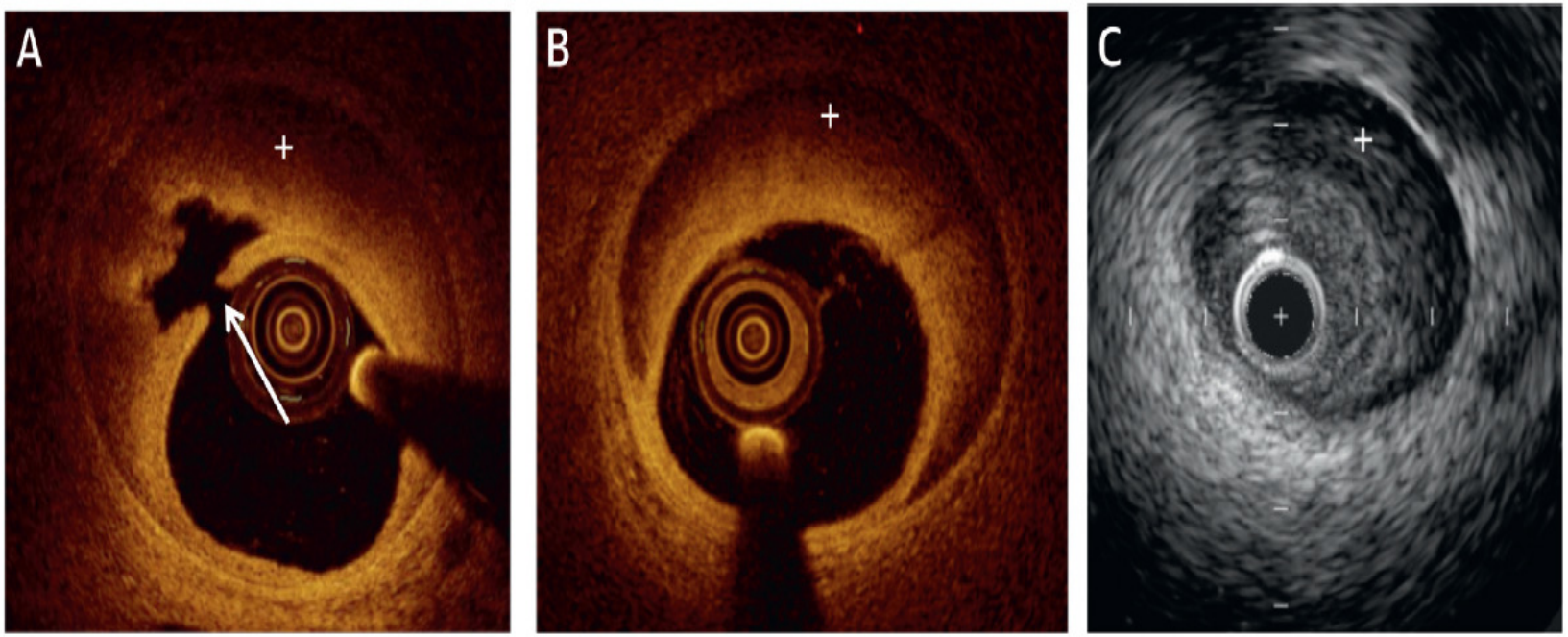
- LAD COMMONLY INVOLVED .(34%)
- LAD BRANCHES 45%.
- CIRCUMFLEX 15%.
- RCA 10%

INTRACORONARY IMAGING

- OCT AND IVUS .
- OCT HAS SUPERIOR RESOLUTION .
- ADVANTAGES – DEFINITIVE DIAGNOSIS OF SCAD , CONFIRMS TRUE LUMEN,FACILITATE DIAGNOSIS OF ARTERIOPATHY.
- DISADVANTAGES – COST,AVAILABILTY,EXTENDING DISSECTION,VESSEL OCCLUSION.

INTRACORONARY IMAGING

FIGURE 5 Intracoronary Imaging of SCAD



MANAGEMENT OF SCAD

- NO RANDOMIZED TRIALS.
- MEDICAL THERAPY OR REVASCULARISATION .
- OBSERVATIONAL SERIES FOR MANAGEMENT .

OBSERVATIONAL SERIES

TABLE 3 Demographics, Presentation, and Cardiovascular Outcomes in Contemporary SCAD Series

First Author (Ref. #)	Year	N	Age (yrs)	Women	ACS	STEMI	NSTEMI	Revasc, PCI*	PCI Success	In-hosp Death	In-hosp MI	In-hosp Urgent Revasc	Median F/U Time	F/U Death	F/U MI	F/U SCAD	F/U Revasc	F/U HF
Alfonso (8)	2012	27	53.0 ± 11.0	85.0	85.0	52.0	33.0	55.6, 100.0	80.0	0.0	0.0	7.4	730 days	0.0	0.0	NR	3.7	3.7
Saw (9)	2014	168	52.1 ± 9.2	92.3	100.0	26.1	73.9	20.2, 82.3	63.6	0.0	4.8	4.8	6.9 yrs	2.4	15.5	13.1	6.5	0.0
Tweet† (10)	2014	189	44.0 ± 9.0	92.0	100.0	37.0	63.0	50.3, 93.7	47.0	0.5	0.0	7.0	2.3 yrs	2.0	19.6	27.0	25.0	13.0
Lettieri (11)	2015	134	52.0 ± 11.0	91.0	93.0	49.2	40.3	42.0, 91.1	72.5	2.2	5.2	5.8	22 days	3.1	1.6	4.7	4.6	3.9
Rogowski (12)	2015	64	53.0 ± 11.2	94.0	100.0	69.0	30.0	12.5, 87.5	66.7	1.5	0.0	0.0	4.5 yrs	0.0	6.3	6.3	0.0	0.0
Roura (14)	2015	34	47.0 ± 12.0	94.1	100.0	55.0	45.0	23.5, 100.0	75.0	0.0	0.0	0.0	121 days	0.0	5.9	2.9	0.0	0.0
Rashid (13)	2016	21	53.3 ± 8.8	95.2	100.0	34.8	56.5	28.6, 100.0	66.7	0.0	0.0	NR	NR	NR	NR	NR	NR	NR
Nakashima (15)	2016	63	46.0 ± 10.0	94.0	100.0	87.0	13.0	55.6, 97.1	91.0	NR	NR	NR	2.8 yrs	1.6	28.6	22.0	NR	NR

Values are % or mean ± SD. *The first percentage is those who had revascularization, and the second percentage is the proportion of those who underwent revascularization that was PCI. †Follow-up events for this study are Kaplan-Meier estimates.

ACS = acute coronary syndrome; F/U = follow-up; HF = heart failure; In-hosp = in-hospital; MI = myocardial infarction; NR = not reported; NSTEMI = non–ST-segment elevation myocardial infarction; Revasc = revascularization; STEMI = ST-segment elevation myocardial infarction; other abbreviations as in Tables 1 to 3.

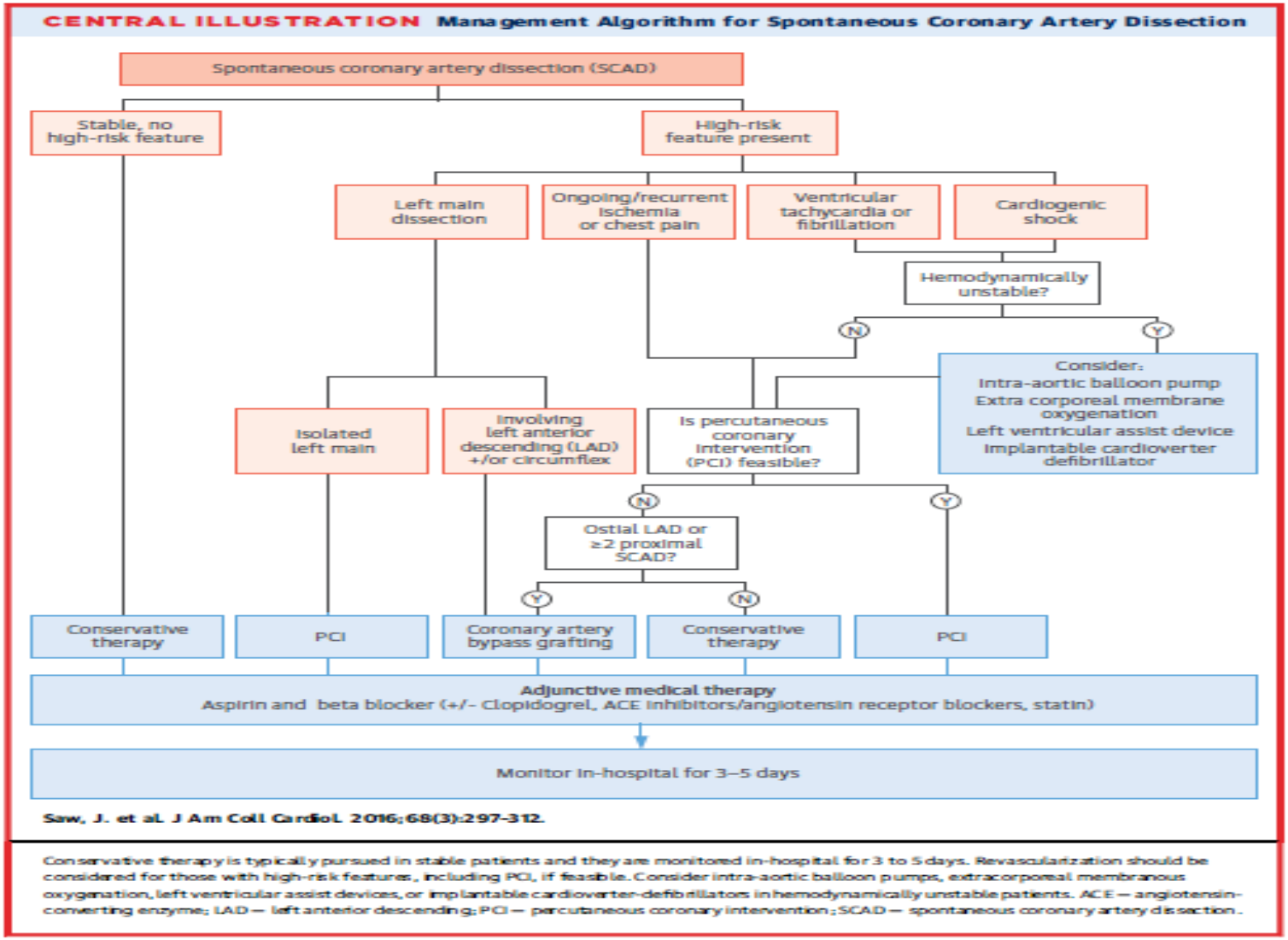
CONSERVATIVE THERAPY

- CONSERVATIVE APPROACH IS PREFERRED .
- SCAD ARTERIES HEAL SPONTANEOUSLY .
- PCI IS ASSOCIATED WITH HIGH FAILURE RATES
- REPEAT ANGIOGRAM TO BE PERFORMED.
- AVERAGE OF 4-6wks POST DISSECTION IS REQUIRED FOR COMPLETE HEALING.
- RESIDUAL DISSECTION AT FOLLOW UP IN SMALL NUMBER OF PATIENTS .

MEDICAL THERAPY

- BETA BLOCKERS.
- ANTIPLATELET THERAPY.
- ANTICOAGULANT AND THROBOLYTIC THERAPY.
- ACE INHIBITORS / ARB.
- LIPID LOWERING THERAPY.

SCAD TREATMENT APPROACH



Saw, J. et al. J Am Coll Cardiol. 2016;68(3):297-312.

Conservative therapy is typically pursued in stable patients and they are monitored in-hospital for 3 to 5 days. Revascularization should be considered for those with high-risk features, including PCI, if feasible. Consider intra-aortic balloon pumps, extracorporeal membranous oxygenation, left ventricular assist devices, or implantable cardioverter-defibrillators in hemodynamically unstable patients. ACE = angiotensin-converting enzyme; LAD = left anterior descending; PCI = percutaneous coronary intervention; SCAD = spontaneous coronary artery dissection.

REVASCULARISATION

- ONGOING OR RECURRENT ISCHEMIA.
- HAEMODYNAMIC INSTABILITY .
- VENTRICULAR ARRTHYMIAS.
- LEFT MAIN DISSECTION .

CHALLENGES DURING PCI OF SCAD

- RISK OF CATHETER INDUCED DISSECTION.
- DIFFICULTY IN ADVANCING CORONARY WIRE IN TRUE LUMEN.
- PROPAGATING IMH .
- DISSECTION TENDS TO EXTEND INTO DISTAL SMALL ARTERIES.
- LONG STENTS.
- STENT MALAPPOSITION.

PRECAUTIONS DURING PCI IN SCAD.

- METICULOUS GUIDE GUIDE CATHETER MANIPULATION.
- FEMORAL APPROACH.
- OCT/IVUS GUIDANCE TO CROSS WIRE IN TRUE LUMEN.
- LONG STENT TO COVER PROXIMAL AND DISTAL 5-10MM.
- FOLLOW UP OCT/IVUS TO ASSESS MALAPPOSED STENTS.

CABG

- LEFT MAIN DISSECTION.
- EXTENSIVE DISSECTION INVOLVING PROXIMAL ARTERIES.
- PCI FAILED.

CONCLUSION

- SCAD IS NOT AS RARE AS PREVIOUSLY REPORTED .
- SCAD SHOULD BE CONSIDERED IN YOUNG WOMEN PRESENTING WITH ACS .
- CONSERVATIVE THERAPY IS PREFERRED .
- ACUTE SURVIVAL IS GOOD.
- LONG TERM MACE ARE FREQUENT .
- MORE RANDOMIZE TRIALS .

THANK YOU .